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|-------------------------------|---------------------------|------------------|--|
| <b>Notice of Allowability</b> | Application No.           | Applicant(s)     |  |
|                               | 10/540,389                | TAKEI ET AL.     |  |
|                               | Examiner<br>Ling-Siu Choi | Art Unit<br>1796 |  |

**— The MAILING DATE of this communication appears on the cover sheet with the correspondence address—**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.  This communication is responsive to the Amendment filed 09/07/2007.
2.  The allowed claim(s) is/are 1-10 and 12.
3.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a)  All
  - b)  Some\*
  - c)  None
 of the:
  1.  Certified copies of the priority documents have been received.
  2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4.  A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5.  CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a)  including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1)  hereto or 2)  to Paper No./Mail Date \_\_\_\_\_.
  - (b)  including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1.  Notice of References Cited (PTO-892)
2.  Notice of Draftsperson's Patent Drawing Review (PTO-948)
3.  Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4.  Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5.  Notice of Informal Patent Application
6.  Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_.
7.  Examiner's Amendment/Comment
8.  Examiner's Statement of Reasons for Allowance
9.  Other \_\_\_\_\_.

**DETAILED ACTION**

1. The request filed on 10/23/2007 for a request for Continued examination (RCE) under 37 CFR 1.114 based on parent Application No. 10/883,551 is acceptable and a RCE has been established. An action on the RCE follows.
2. This Office Action is in response to the Amendment filed 09/07/2007. Claims 11 and 13 were canceled and claims 1-10 and 12 are now pending.

***Allowable Subject Matter***

3. Claims 1-10 and 12 are allowed.
4. The following is an examiner's statement of reasons for allowance:

The present claims are allowable over the closest references: Rutter et al. (EP 1 150 343 A2), Takei et al. (EP 1 315 045 A1), and Meador et al. (US 5,919,599).

## Summary of Claim 1:

|   |  |
|---|--|
| A gap fill material forming composition for manufacturing semiconductor by  |  |
|   | <ul style="list-style-type: none"><li>■ coating a photoresist on a substrate having a hole [aspect ratio <math>\geq 1</math>],</li><li>■ transferring an image to the substrate using a lithography process;</li><li>□ coating the composition on the substrate,</li><li>□ baking the composition,</li><li>□ contacting the composition with an alkaline aqueous solution after baking, and</li><li>□ coating the photoresist,</li></ul> |
|   | <p><u>the composition</u> comprising:</p> <ul style="list-style-type: none"><li>• a polymer having a hydroxy group or a carboxy group;</li><li>• a crosslinking agent; and</li><li>• <u>an alkali-dissolution rate regulator</u> [naphthoquinone compounds, compounds having a t-butoxycarbonyl group, compounds having a hydroxyl group, compounds having a carboxy group, and compounds having a phenyl group]</li></ul>               |
| wherein a gap fill material layer manufactured by coating and baking the gap fill material forming composition on a semiconductor substrate has<br>a dissolution rate ranging from 3 to 200 nm per second for an alkaline aqueous solution having a concentration of 0.1% to 20%. |  |

Rutter et al. disclose a composition for an antireflective coating, comprising one or more crosslinkable polymers having a weight average molecular weight of less than or equal to about 8,000, wherein the crosslinkable polymer comprises at least one hydroxyl group containing monomer, wherein the crosslinker includes di-, tri-, tetra, or higher multi-functional ethylenically unsaturated monomer; the hydroxy group containing monomer is aliphatic or aromatic, which is vinyl phenol, vinyl cresol, vinyl methoxy phenol, hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl

(meth)acrylate, hydroxycyclohexyl (meth)acrylate, hydroxyphenyl (met)acrylate, diethyleneglycol (meth)acrylate....hydroxyethyl itaconate ([0027]; [0043]; claim 1). Rutter et al. further disclose that the composition comprises acid catalyst which includes free acid and acid generator. However, Rutter et al. do not teach or fairly suggest the claimed gap fill material forming composition, wherein the composition comprises the specific alkali-dissolution rate regulator and the resulting gap fill material layer has the specific dissolution rate in the alkaline aqueous solution.

Takei et al. disclose a composition for forming a gap-filling material to be used in a semiconductor device by a method of applying the composition to the substrate with holes having an aspect ratio of at least 1 to planarize the surface of the substrate; then applying a resist coating onto a substrate; and finally transferring an image on the substrate using a lithographic process, wherein the composition comprises a polymer having a weight average molecular weight of 500 to 30,000, a crosslinking agent, and additives (page 3, lines 55-56; [0066]-[0069]; claims 1 and 17). Takei et al. further disclose that the polymer is poly(p-vinylphenol), poly(styrene-co-p-vinylphenol), poly(methyl methacrylate-co-p-vinylphenol), poly(2-hydroxyethyl methacrylate-co-p-vinylphenol), poly(butyl acrylate-co-p-vinylphenol), or novolac type phenol resin (Example 6; claims 11 and 13-16). However, Takei et al. do not teach or fairly suggest the claimed gap fill material forming composition, wherein the composition comprises the specific alkali-dissolution rate regulator and the resulting gap fill material layer has the specific dissolution rate in the alkaline aqueous solution.

Meador et al. disclose a deep ultraviolet antireflective composition comprising (A)

the reaction product of an acrylic polymer or copolymer and a deep ultraviolet light absorbing carboxylic acid or phenolic dye to produce a polymer or copolymer linked to the carboxylic acid or phenolic dye via a hydroxyester moiety or a hydroxyether moiety respectively, (B) a crosslinking agent, and (C) an acid catalyst (Fig. 1; claim 1). However, Meador et al. do not teach or fairly suggest the claimed gap fill material forming composition, wherein the composition comprises the specific alkali-dissolution rate regulator and the resulting gap fill material layer has the specific dissolution rate in the alkaline aqueous solution.

In light of the above discussion, it is evident as to why the present claims are patentable over the prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ling-Siu Choi whose telephone number is 571-272-1098.

If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reach on 571-272-1114.

Application/Control Number: 10/540,389  
Art Unit: 1796

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*Ling-Sui Choi*  
LING-SUI CHOI  
PRIMARY EXAMINER

January 4, 2007